FAMILY GUIDE TO MANAGEMENT OF SPASTICITY

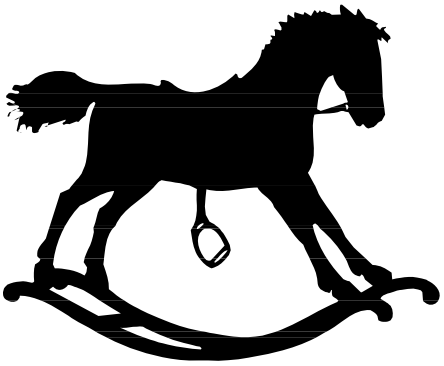

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Table of Contents

Page

I. Introduction 3

II. Physical Therapy, Occupational Therapy, Speech Therapy 4

III. Positioning 6

IV. Medications 8

V. Nerve and Muscle Blocks 9

VI. Post Block Follow-up 12

VII. Therapeutical Electrical Stimulation 13

VIII. Acupuncture 14

IX. Intrathecal Baclofen Pump 16

X. Surgical Options 17

XI. Bibliography 19

I. Introduction

The information in this booklet has been compiled to help families understand the different treatments or combinations of treatments that may be suggested for management of your child's spasticity or dystonia.

Spasticity in children with brain injury, cerebral palsy or spinal cord injury is very common but often difficult to treat. In its most general term, spasticity is "increased resistance to passive movement or muscle stretch, which can interfere with mobility, self-care, positioning, and ultimately lead to joint contractures. This occurs when there is an illness or injury which affects the brain, brain stem, or some area of the spinal cord. Individuals who have spasticity have increased reflexes and clonus (a rapid up-and-down movement about a joint in response to muscle stretch). Dystonia is a type of movement disorder that is characterized by intermittent "posturing". Many children have a combination of spasticity and dystonia. For the remainder of this booklet, we will use spasticity to describe the movement difficulty, with the understanding that dystonia may also be a component.

There are numerous ways to treat spasticity. These include stretching, strengthening, orthotics, casting, therapeutic electrical stimulation, nerve or muscle blocks, medications, tendon lengthening and other orthopedic procedures, and dorsal rhizotomy. The goal of these treatments is to increase range of motion of a joint and decrease spasticity. This may help to increase functional mobility.

Consider discussing the following ideas with your physician when considering treatment for spasticity:

1. How do we decide which treatment course to follow?
2. Can the treatment be expected to help decrease spasticity?
3. What are the expectations and probable outcome?
4. Do the potential benefits outweigh the risks?
5. What will be the therapy program after treatment?
6. How will treatment effects be measured?

Spasticity is a problem when it interferes with function including movement, hygiene, or positioning. We will use a circle as our model for treating spasticity, with different parts of the circle representing different treatment options. We can move around the circle to use different options at various points in a child's growth and development. A combination of treatment options can be used at the same time.

TREATMENT OPTIONS FOR SPASTICITY

II. Physical Therapy, Occupational Therapy, and Speech Therapy

Recommendations for therapy are based on a child's current level of functioning. Not all children need each type of therapy. Therapy recommendations will change over time. Furthermore, the goals of each specific therapy will change as the child's functional goals and movement patterns change.

A. Physical Therapy

Physical therapy programs are designed to help a child obtain maximal functional independence in the home, school, and community. When muscles are "spastic", there is an imbalance of the muscle pull around a joint. This increases a child's risk of developing a joint deformity or a muscle contracture. Physical therapy is prescribed to help improve gross motor function and maintain range of motion to prevent joint deformities and muscle contractures.

There are several different approaches of physical therapy for children. Many therapists use a combination of philosophies. Examples of different therapy models include neurodevelopmental therapy (NDT), Proprioceptive Neuromuscular Facilitation (PNF), conductive education, and manual therapy (myofascial release and craniosacral therapy). Hippotherapy, or horse back riding, can help a child increase balance and improve trunk control. Aquatic therapy can help promote more typical patterns of movement that are often affected by gravity.

Each child should have a home exercise program. It is essential for you to be aware of the goals of therapy. Your child only spends a few hours a week with a therapist. However, your child spends the rest of his/her time with you. Therefore, if you can learn to carry out the techniques of therapy, therapy will offer greater benefits for your child. Parents can learn ways to increase and/or maintain range of motion in muscles, position a child, supervise exercises to strengthen muscle groups, and provide support to a child to improve functional movement.

Physical therapists also help design adaptive equipment including orthotics, seating systems and wheelchairs. There are also different modalities which physical therapists can use to help relax or strengthen muscles to improve function. Again, it is important for all individuals working with a child to be able to incorporate the goals of therapy into activities of daily living.

B. Occupational Therapy

Occupational therapists work with children in many different ways. They work to help improve upper extremity function, improve trunk balance, increase independence with activities of daily living, improve visual perceptual skills, and provide appropriate adaptive equipment to maximize independence. Occupational therapists often work together with other disciplines to incorporate therapy goals into a child's regular activities.

When a child has spasticity in his/her arms or hands, it can interfere with coordination as well as function. A child may have low tone in his or her trunk or neck which interferes even more with the child's ability to use his or her hands to play with objects in the environment.

The occupational therapist must be able to evaluate each child's individual needs and develop a program to help improve head and trunk stability as well as fine motor skills. There are also times when adaptive equipment such as hand splints or forearm splints may be needed to improve hand function. It is the occupational therapist who would make these splints.

Many children receive occupational therapy both in school and at home. Usually, the occupational therapy which a child receives in school focuses more on school related activities. If a child needs help increasing independence with activities of daily living such as hygiene, dressing, or bathing, additional therapy might be needed for these skills. Sometimes, school therapists do not feel as though they can address functional skills. Again, it is important for parents to become familiar with the goals of a child's occupational therapy program. Recommendations made by a therapist to adapt different areas of the home and/or school will be important to allow the child to gain greater functional independence.

C. Speech Therapy

Speech therapists work on a variety of activities including increasing oral motor skills, cognitive skills, and communication skills. An additional focus area is feeding skills. Eating is a complex activity. A child should be able to take food off a spoon or fork, then chew and swallow it. If this can not be done safely, a child may need a special feeding tube called a gastrostomy tube. Therapy can focus on improving oral motor skills for swallowing and communication.

There are several different components involved in eating/swallowing. A speech therapist can work together with an occupational therapist and/or physical therapist to maximize independence with eating. The speech therapist will focus on the activity of the muscles around the mouth, tongue and oropharynx. The occupational therapist works on fine motor skills involved with eating. The physical therapist can work on positioning and trunk control. The goal is to enable the child to eat safely without the risk of getting food in the lungs (aspiration). Again, it is important for family members to learn the goals of a child's speech therapy program.

Speech and language pathologists also work on improving strategies for learning and increasing social and communication skills. Many times a child with muscle imbalance in the trunk or neck will have trouble breathing or speaking. If a child is able to breath more easily, speaking may improve. Also if a child's trunk is positioned better, swallowing will be easier.

III. Positioning

Children who have muscle imbalance secondary to spasticity may need adapted equipment to help maintain range of motion, prevent joint deformity, and maximize functional independence. This equipment can include soft body jackets, special seating, or special orthotics for the hands or the feet.

A. Equipment that Improves Positioning

There are many ways that equipment can be adapted to help a child sit in a better position. Controlling the position of a child's pelvis, knees, and ankles can help decrease arching, increase head control and shoulder stability, and improve functional hand use. Children may need different types of equipment at different times during their growth and development. Again, the goal is to increase control of movement and manipulation of objects in the environment. Some examples of equipment that can help improve positioning are:

1. Adapted strollers
2. Wheelchairs
3. Bath chairs
4. Adapted car seats
5. Adapted seating for general use
6. Standers
7. Gait Trainers

B. Orthotics

Orthotics are designed to help provide support to weak muscles and minimize the risk of joint deformity. There are a variety of orthotics made from a number of different materials. The goal is to use an orthotic which can give support depending on a child's pattern of movement, avoid skin breakdown, and be comfortable. If areas of the skin become red, this indicates that the orthotic may not be fitting appropriately, especially if the redness lasts more than half an hour after removing the orthotic.

1. Ankle foot orthoses (AFO's)
2. Leg braces or casts
3. Hand splints
4. Soft body jackets

C. Serial Casts to Gain Range of Motion

Serial casts can either be used for the arms or the legs. The goal is to maintain or increase range of motion of a muscle, tendon, or joint. The casts provide a sustained stretch across the joint. Prolonged stretch can help muscles relax. The cast may also help "soften" tendons.

Serial casts are normally changed one time per week. The number of total weeks of casting varies depending on the need of each child. The goal is to slowly gain more joint range without causing significant discomfort to the child.

D. Inhibitive Casts to Improve Function

Inhibitive casts are used to increase function more than to improve range of motion. Sometimes, inhibitive casts will be used to "give more information" (proprioception) to the ankle joint or the foot in order to prevent a child from using "reflex patterns" of movement. They are often utilized when a child with muscle imbalance is learning to walk. They can give better proprioceptive input to the foot when compared to the AFO since they are heavier and can have special features built in to them.

For example, inhibitive foot plates can be built into the base of each cast. The inhibitive foot plates apply pressure to different areas of the foot to give better proprioceptive input to the joint which inhibits reflex patterns of movement. Often times, we will use inhibitive casts prior to prescribing orthotics, depending on a child's function.

IV. Medication

Medications might only be used for "short periods" of time. Some medications require a several week dose advancement schedule in order to get an appropriate level of response. The dose of medication is increased slowly to prevent side effects such as sleepiness. Occasionally, medications will require monitoring bloodwork for certain side effects.

a) **Baclofen (Lioresal)**

Baclofen works at the level of the spinal cord on the interneuronal connections that use the neurotransmitter GABA.

Side effects are minimal but do include sedation and possibly problems with swallowing. This medication must not be stopped suddenly. It must be decreased slowly over time to prevent seizures.

b) **Diazepam (Valium)**

Valium acts in the upper part of the central nervous system to enhance the normal inhibitory effects of the neurotransmitter GABA.

Side effects include sedation, memory impairment, and possible respiratory depression.

c) **Clonazepam (Klonopin) -** Effects are similar to Valium.

d) **Dantrolene Sodium**(**Dantrium)**

Dantrium works directly on the muscle at the level of the muscle fiber to block calcium release which is necessary for muscle contractions. Dantrium makes it difficult for spastic muscles to maximally tighten.

Side effects include sedation and possible liver problems. As a result, blood tests are needed to monitor liver function. Approximately 1% of people on Dantrolene experience liver dysfunction. Lab work needs to be done 2 to 4 times per year to monitor liver functions.

e) **Tizanidine (Zaniflex)**

Tizanidine is a medication, which was approved for use in 1996 for the treatment of adults with spasticity from spinal cord injuries and multiple sclerosis. The safety of the drug for children has not been established. However, the company that manufacturers the drug states that they feel that the medication is safe for children. Dosing recommendations for children are outlined by the manufacturer.

V. Nerve and Muscle Blocks

A. Botox Injections (Botulinum type A toxin)

Children who benefit most from Botox are those who are too young for surgery or for whom surgery is not yet warranted. Botox injections can provide an opportunity to evaluate the child's readiness for more permanent orthopedic procedures. In some cases, injections can provide enough spasticity control that surgery can be avoided.

Botox injections can help improve a child's ability to walk or use their hands and allow for a better fitting orthotics by reducing spasticity. Therapists can take advantage of the time when an overly powerful muscle is weakened to work on strengthening the muscle on the opposite side of the joint (antagonist). Sometimes, casting of the involved extremity is done after the injection to increase the stretch of the tight muscle.

When injected into the muscle, Botox interferes with the release of a chemical, acetylcholine, at the junction of the muscle and nerve. This partially interrupts muscle contraction making the muscle temporarily weaker. This becomes evident two to ten days after treatment and lasts approximately 3 to 6 months.

Botox is currently being used to treat spasticity due to multiple sclerosis, head injury, stroke and spinal cord injury. It has been used to relieve movement disorders of the head and neck, such as torticollis. Most recently, botulinum toxin has been used successfully to treat spasticity in children due to the muscle imbalances caused by cerebral palsy. "Dynamic deformities" unresponsive to other treatments, may improve following Botox, delaying or preventing the need for surgery or orthotics.

Blocking Agent	Administered	Effectiveness	Advantages	Drawbacks	Complications
Botulinum Type A Toxin	Injected into the muscle	Lasts 3 to 6 months	Painless and easy to administer Diffuses readily into the muscle Effects are transient lasting 3 to 6 months Can be administered without anesthesia	Effects are transient lasting 3 to 6 months Limited approval by some insurance companies Expense	No significant complications have been reported

Procedure

Botox is injected directly into the spastic muscle where it diffuses only a short distance. It is dosed according to total body weight and injections can be repeated after three months. Up to 10% of patients already have antibodies to botulinum toxin and may not respond to the injections. Children should not be on an aminoglycoside antibiotic when Botox is injected as it may also interfere with response to the Botox.

Botulinum toxin is injected through a very small needle much like an immunization, and side effects are few. Local tenderness can occur but is related to the volume administered. Occasionally there may be a skin irritation or rash. Sometimes a special needle is used which electrically localizes the muscle where the Botox is needed. This medication can be injected in a clinic setting with the option of using a topical anesthetic for the skin and/or mild sedation.

The reported side effects of this procedure include pain at the injection site and, in some cases, generalized fatigue of short duration. This medication is felt to be very safe at the therapeutic doses used.

Benefits

The muscle relaxation resulting from Botox can provide comfort and ease of care for those patients in whom spasticity causes pain or difficulty with hygiene.

1. The effects of botulinum toxin are seen two days to ten days after the injection and the results last about three to six months.

2. If you choose Botox as the method to decrease the spasticity, please read the following:

    a) We will use a topical cream to numb the area of the injection. This takes about 30-45 minutes to start working.

    b) If we are doing several injections, without anesthesia, we may need to give another medicine to make the procedure easier for your child to tolerate. Therefore, please don't eat or drink anything two hours before your appointment.

    c) We will need to see you back in clinic in one week after your injection to start a serial cast program.

Summary

Overall, Botox provides a non-operative way to manage spasticity in a relatively pain- and risk-free manner.

B. Phenol Injections

Phenol is an alcohol based drug which partially dissolves the "covering of the nerves" (myelin), slowing the messages to muscle. Myelin will typically re-coat the nerve after 4-12 months. For this reason, phenol blocks are considered temporary, and can be redone. Phenol is currently being used to treat spasticity due to multiple sclerosis, head injury, strokes, spinal cord injury and cerebral palsy. "Dynamic deformities" unresponsive to other treatments, may improve following phenol, delaying or preventing the need for surgery or orthotics.

Procedure

Phenol is injected around the "motorpoint," where a nerve branch enters the muscle. The motorpoint is localized using a small needle which is attached to an electrical simulator. This produces small muscle contractions letting physicians know they are in the correct place. The localization process requires the patient to be still. The injections may cause a mild burning sensation. For this reason, young children may tolerate the procedure better if it is done in day surgery with a general anesthetic. The procedure generally takes between 10 and 20 minutes, so the anesthetic time is brief. For older patients, the injections can be done in a clinic setting, using a topical anesthetic to numb the skin, with mild sedation if needed. The effects of phenol are seen immediately.

Side effects of phenol can be mild bruising where the medicine is injected, but this generally resolves after a few days. Transient numbness or tingling can also occur if the drug is injected near a sensory nerve. Also, a muscle pull can occur if the treated muscles are not given time to slowly stretch out. Aggressive therapy is not recommended for a few days after the blocks, to avoid this problem.

Blocking Agent	Administered	Effectiveness	Advantages	Drawbacks	Complications
Phenol Block	Injected into the motor points of the involved muscle	Lasts 4 to 12 months	Use is widely approved Lasts longer than botulinum toxin Cumulative effects can occur Effects seen immediately	Can be painful May require general anesthesia during administration	Transient dysesthesias and numbness Bruising and muscle pulls can occur

Benefits

Phenol neurolysis or "blocks" have been used for many years for the purpose of increasing range of motion, and to decrease rigidity and spasms, and continue to be very effective in reducing spasticity, particularly in the lower extremities.

Muscles most commonly treated with phenol blocks are the hip adductors and the hamstrings. If they are too tight, they can cause significant problems with gait and seating. Phenol dosing is not

based on a child's weight, so it may be more effective to use in large muscle groups than Botox, which has a maximum dose based on a child's weight. These two drugs are often used in combination for more effective treatment.

Children who benefit most from neurolytic agents are those who are too young for surgery or for whom surgery is not yet warranted. Phenol neurolysis can provide an opportunity to evaluate the child's readiness for more permanent orthopaedic procedures. In some cases, injections can provide enough spasticity control that surgery is not necessary.

Phenol blocks can help improve a child's ambulation and allow for a better fitting orthotic by reducing spasticity. Therapists can take advantage of the time when an overly powerful muscle is weakened, to work on strengthening the antagonistic muscles. Sometimes, casting of the involved extremity is done at the same time or shortly after an injection to increase the stretch on the muscle.

VI. Post Block Follow-up

If your child has had anesthesia, there are certain things that need to be monitored after the procedure is completed. Your child does not have to stay in bed. There are certain exercises that need to be limited for one week if your child has had phenol injections. Otherwise, with the Botox, there are no precautions.

After a child has anesthesia, it is recommended that small amounts of ginger ale, ice pops, Jello, apple juice, or soup with crackers be given. On the day after the procedure, the child may go back to his or her regular diet.

Phenol injections can cause some discomfort. For the first 24 hours after the injection, a child may use Tylenol (acetaminophen) or Motrin (ibuprofen) for the discomfort. Children who have had Botox injections, usually have minimal pain. However, if there is some discomfort, we recommend using Tylenol.

In general, any child who has had anesthesia may be irritable for a while. It is advisable to plan quiet activities. However, as a child feels better, he or she may return to normal activities.

If you have any concerns after the injections, call your physician. Look for any swelling, redness, or drainage at the injection sites. If a child has more than mild discomfort, this is another reason to call. If there is any color change, coolness, numbness, swelling, or tingling of the arm or leg, please let the doctor know.

A child's physical therapist or occupational therapist is encouraged to call the physician to further discuss program goals. If the gastroc muscles have been injected with Botox, we will often begin serial casting one week after the blocks. This depends on a child's response. It is recommended that all children follow up with the physician who did the blocks one to two weeks after completion of the injections.

VII. Therapeutic Electrical Stimulation

Therapeutic Electrical Stimulation (TES) stimulates muscle growth to diminish the effects of spasticity. TES involves the use of nighttime low level electrical stimulation to produce muscle growth. The stimulus is adjusted so that a muscle contraction is not produced.

The current is delivered through the skin using water activated adhesive electrodes. These electrodes are placed over the weak and non-spastic antagonist muscles. All of the therapy is done at home, at night while the child sleeps.

The exact mechanism of action of TES is not known. It is possible that TES improves blood flow to stimulate local muscle growth. TES may capitalize on the natural growth and repair function of sleep. Another potential benefit of TES is decreasing spasticity during some phases of sleep. In this way the stimulus can be given to the non-spastic antagonist muscle without initiating a co-contraction.

Technique	Age Group	Technique	Purpose	Benefits	Risks/side effects
Therapeutic Electrical Stimulation	Pediatric Adult	Low-level stimulation delivered at night during sleep	To stimulate end-organ growth of both muscle and (potentially) bone.	Growth in muscle bulk to increase strength Decreased tone and hyperreflexia Improved function Improved bowel and bladder function in some patients Improved fine motor skills	Mild skin irritation Equipment misuse/malfunc-tion Sleep disturbance Transient bladder instability Contraindicated in balanced spasticity

VIII. Acupuncture

Acupuncture is a method of encouraging the body to promote natural healing and to improve functioning. It is done by inserting needles and applying heat or electrical stimulation at very precise points on the body. This is considered an alternative treatment.

According to classical Chinese teachings, there are channels of energy that run in regular patterns through the body and over its surface. The energy is perceived to be like a river, flowing through the body to nourish the tissues. If there is an obstruction in the movement of these "energy rivers", a "dam" develops that backs up the flow in one part of the body and restricts it in others. The philosophy behind acupuncture is that by needling the acupuncture points, the nervous system is stimulated to release chemicals in the muscles, spinal cord, and brain. These chemicals can trigger the release of other chemicals and hormones which influence the body's own internal regulating system.

The improved energy and biochemical balance produced by acupuncture results in stimulating the body's natural healing abilities. In some cases surface electrodes can be used instead of needles.

Treatments

The number of treatments needed for a condition differs for every individual. If a condition is long-standing, one treatment a week for several months may be recommended.

Side effects

As energy is redirected in the body, internal chemicals and hormones are stimulated and healing begins. Occasionally, symptoms may worsen for a few days. This should not be a concern as it is simply an indication that the acupuncture is starting to work. It is also quite common with the first few treatments that a sensation of deep relaxation or mild disorientation may immediately follow the treatment. These pass within a short time.

Acupuncture treatments can be given at the same time as other techniques are being used. It is important that both the physician and the person who is doing the acupuncture know everything that is happening with the child so that the maximum benefits can be achieved from the treatments.

On the day of treatment

To enhance the value of a treatment session, there are a few guidelines which need to be followed.

- The child should not eat an unusually large meal immediately both before or after treatment.
- Do not over-exercise within six hours before or after treatment.
- Plan activities so that after the treatment the child can rest or at least not have to be working at top performance.
- Continue to take any prescription medicines as directed by your regular doctor.

Insurance Coverage

Since acupuncture is considered an alternative treatment, some insurance companies will cover acupuncture costs but many insurance companies do not. Each health policy should be reviewed to determine if there are benefits for acupuncture treatment.

IX. Intrathecal Baclofen Pump

Baclofen was introduced initially as a drug to treat spasticity. It is taken by mouth. It is a gamma-amino-butyric acid (GABA) analogue that has an inhibitory action on spinal cord synapses. Baclofen helps produce a "quieting" response message, that goes from the spinal cord to the muscle.

Because Baclofen crosses the blood brain barrier poorly, it is a good agent for delivery by the more direct intrathecal route, where much lower doses are required and are associated with few side effects. Intrathecal Baclofen administered by an implanted pump has been used in both children and adults with spasticity. The technique requires the surgical implantation of a radio frequency- controlled medication pump and the placement of a catheter in the subarachnoid space. Direct intrathecal delivery of the medication reduces systemic side effects. This technique allows the physician to address the drug dose for varying degrees of spasticity. When successful, it allows for improved sleep, decreased pain, and enhanced mobility due to reduced spasticity.

Technique	Age	Procedure	Purpose	Benefits	Risks/Side effects
Baclofen Pump	Children Adults	Surgical implant of radio frequency-controlled medication pump	Direct inhibition messages in the spinal cord which quiet the spastic flexion reflexes.	Decreased spasticity Drug dosage adjusted to varying degrees of spasticity Potential improvement in function Reversible effects	Anesthesia risk Infection Pump/catheter malfunction Life-long dependence on pump Transient hypotension

X. Surgical Options

1. Tendon lengthenings, transfers, or releases

Tendon lengthenings reduce the tension on a muscle which decreases muscle tightness. The procedure is done in a variety of ways. Sometimes the muscle is divided lengthwise into two halves. The two ends are then re-adjoined to create a longer single tendon.

Sometimes, tendons can be moved from one position and attached to another with stitches in order to balance the alignment of a joint. After tendon transfers, it is usually necessary to wear solid casts, over the joint which is being addressed for approximately 3 to 6 weeks.

The tough covering around the muscle can also be cut. Tendons and muscles are left intact. When the tough covering around the muscle is cut, greater range can be obtained. The muscle is then casted in a lengthened position for approximately three weeks. This allows the covering to scar down onto the muscle. One of the shortcomings of this procedure is that it may need to be repeated in the future after a growth spurt.

2. Myotomy

In a myotomy, a muscle is actually cut and released. The muscle scars down onto a muscle near it.

3. Osteotomy

In an osteotomy, a bone is actually cut and repositioned in a more functional position to correct alignment. A metal plate and screws are inserted to hold the realigned bone into good position as it heals. This requires a longer period of casting. Usually, six weeks in a non-removable cast and six additional weeks in bivalve cast.

It takes the bone approximately 9 to 12 months to heal fully. Once the bone is healed, the metal plate and screws can be removed, usually as an outpatient operation.

4. Posterior Rhizotomy

Posterior Rhizotomy is a neurosurgical technique that aims to reduce peripheral spasticity in the lower limbs. It was first used experimentally in 1898 and was re-introduced for the pediatric population in 1981. The theory is that increased muscle tone is secondary to overactivity of the alpha motor neurons. Posterior rhizotomy reduces the spasticity by dividing some of the posterior sensory rootlets from lumbar to sacral spinal nerves.

Selective rhizotomy divides only those rootlets associated with an abnormal electromyogram (EMG) response to an intra-operative stimulation. The number of affected nerve roots varies from 25% to 80%. Nonselective sectioning of the rootlets is performed without EMG monitoring as well. The extent of surgery is determined by the degree of clinical spasticity. In both techniques, the child requires anesthesia, a laminectomy, and a surgical procedure. The selective technique takes longer due to the intra-operative EMG monitoring.

Children without contractures, deformities, or leg length discrepancies are better candidates. If a child might require multiple orthopedic interventions in order to address spasticity, then it may be more reasonable to consider posterior rhizotomy. Children with severe underlying hypotonia, scoliosis, hemiplegia, or extensive previous surgery are usually excluded from consideration.

After surgery, extensive physical rehabilitation is required in order to strengthen muscles and teach the child new functional patterns. The risks and possible side effects of this technique include an unmasking of underlying hypotonia, transient hyperesthesia, and transient bowel and bladder impairment.

	Age	Technique	Purpose	Benefits	Risks/Side effects
Rhizotomy	Pediatric	Surgical section of posterior roots a) selective b) nonselective	To interrupt the afferent sensory feedback from spastic muscles	Decreased spasticity Improved gross and fine motor skills, speech and bladder function	Anesthesia risk Increased hypotonia Transient hyperesthesia Transient bowel and bladder disturbance Scoliosis Irreversible

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